

PALEONTOLOGY.—*Gaulocrinus*, a new inadunate crinoid genus from the Mississippian.<sup>1</sup> EDWIN KIRK, U. S. Geological Survey.

In the lower Mississippian of Kentucky and Tennessee is a small group of anomalous crinoids. In the main the species have been referred to the Pennsylvanian genus *Stemmatocrinus*, though one has been described as *Mespilocrinus*. Material showing the arm structures has been prepared, and the crinoids prove to represent a new genus.

*Gaulocrinus*, n. gen.

*Genotype*.—*Stemmatocrinus trautscholdi* Wachsmuth and Springer.

Crown. Low, massive, compact.

Dorsal cup. The dorsal cups range from cupuliform (type species) with flattened base and *IBB* not visible in lateral view through cyathiform to crateriform. In the deeper cups the *IBB* are plainly visible in lateral view. In most of the species the plates are very thick. In the holotype of the type species the *RR* have a maximum thickness of 8 mm. The *BB* and *IBB* have approximately the same thickness. This thickness is still greater in larger specimens. The species found in the New Providence of Button Mould Knob is a relatively small one and represented only by dissociated plates and one crushed dorsal cup. Here the maximum thickness of a radial is somewhat less than 4.5 mm. Owing to the great thickness of the plates in most of the species, the cavity of the dorsal cup is relatively small. The plates themselves are pyramidal in form, their dimensions on the inside of the cup being but approximately one-half those on the outside.

*IBB*. In most of the specimens the *IBB* appear to be fused into a solid disk. The greater part of the specimens, however, are silicified, which militates against accurate observations of sutures in the case of closely united plates. Several specimens seem clearly to show a single suture. In at least two specimens two sutures outlining a single infrabasal can be seen. As the cup is symmetrical there is no way of orienting

the sutures as seen. The stellate outline of the infrabasal element in many of the specimens gives good reason to doubt ankylosis of the *IBB*. In all cases known to me where there is ankylosis in the proximal circlet of plates the resultant element has a symmetrical outline without reentrant angles. When two, three, or four elements result from fusion, reentrants are found only where sutures are shown, and even here they are usually not deep. In earlier days a great deal of stress was laid on the number and position of the elements in the proximal circlet. With greater knowledge we have found that such structures may be fairly stable and characteristic in some evolutionary lines and variable in others. Again, sutures may appear in individuals through what Wilson has styled delayed ankylosis. In the case of *Gaulocrinus*, with our present knowledge, the status of the *IBB* may be given as ankylosed with sporadic appearance of sutures. There is a distinct pit for the reception of the column. It is circular, deep, and has vertical walls. The pit is usually submedian in position, but in one undescribed species it seems to be consistently excentric in varying degrees.

*BB*. Large, usually extending to about one-half the height of the cup wall. An interesting feature in older specimens is the sinuous course of the basal-radial suture.

*RR*. Large. The radial facet extends nearly the full width of the radial. As seen in lateral view the *R-IBr* articulation ranges from linear to deeply lunate. The straight or slightly excavate contact is shown chiefly in young individuals or in what are assumed to be stratigraphically older species. It may appear, however, within a species in specimens of the same size as those showing decidedly lunate outlines. The distal face of the radial forms a broad platform. There is a well-defined fulcral ridge. The dorsal ligament fossa is relatively narrow but sharply defined. There is also a well-marked ligament pit. The muscular fossae vary with age. In younger speci-

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mens they are relatively shallow and have a papillose surface. In the largest individuals the fossae are deep and sharply defined. At the lateral ventral margins of the articulating face are triangular facets. Each of these combined with that of the adjacent radial forms a triangular depression that broadens and becomes shallower ventrad. At times, a low ridge delimits the inner margin of the depression. It seems possible that those areas represent inter-articular ligament fossae.

**Arms.** The arms are heavy and short. In the two species where they are preserved, their length is less than the height of the dorsal cup. The *IBrr* are broad, low, and two in number in the two species in which they have been seen. In *G. trautscholdi* the rami do not seem to divide again. In one half-ray there are six secundibrachs preserved. Judging by the rapidity of taper, one would hardly expect another division. In *G. bordeni* there is a second division on the seventh secundibrach.

**Tegmen.** No part of the tegmen has been found in any instance. In at least one specimen the cup is partially filled with dissociated brachials without recognizable plates that could have been derived from the tegmen. It would appear that the tegmen was an incompetent structure made up of many small plates.

**Column.** The column is known only in one specimen, where five of the proximal columnals are preserved. The column has a diameter of 5.0 mm and is circular in section. The columnals are of medium height and, as seen, all of approximately the same height. The sides are somewhat rounded. The face of the columnal is marked by fairly strong, radiating ridges. It is not possible to tell the shape of the lumen in the column itself. As shown somewhat indistinctly in the *IBB* it is pentalobate to pentagonal in outline.

**Distribution.**—*Gaulocrinus* to date has been found in place only in the New Providence of Kentucky and Indiana and an equivalent horizon in Tennessee. Most of the specimens from the White Creek Springs area of Tennessee were found on slopes and bottom lands as

float, and their stratigraphic horizon is uncertain. It has been assumed generally that they are derived from the limestones overlying the New Providence equivalent and of approximately Keokuk age, but this is doubtful.

**Relationships.**—The placement and the differentiation of crinoids with relatively simple structure are difficult. The separation of *Gaulocrinus* from *Stemmatocrinus* is, however, an easy matter on the basis of arm structure alone. *Stemmatocrinus* has long biserial arms. To point out differences between *Gaulocrinus* and species referred to the Permian genus *Calycocrinus* is more difficult, however. Typical *Calycocrinus* has a turbinate cup. The arms are similar to those of *Gaulocrinus*, as for that matter are those of *Edriocrinus* and other widely dissimilar genera. In *Calycocrinus* the articulating face of the radial is narrow, with an indistinct transverse fulcral ridge and a small dorsal ligament pit. There is no platform ventrad and there are no well-defined muscular fossae. The structure is somewhat like that found in such a genus as *Lecanocrinus* and affords some justification for the assignment of *Calycocrinus* to the Flexibilia as now conceived. In *Gaulocrinus* the articulating face is of the type characteristic of many of the heavy-bodied Inadunata. Of what systematic value the articulating faces of the radials may prove to be is a moot point. For our present purposes the striking structural differences shown by the two genera seem sufficient to substantiate the inherently probable wide biologic separation of the two genera.

*Species referred to the genus.*—

***Gaulocrinus bordeni*** (Springer),  
n. comb.

*Mespilocrinus bordeni* Springer, 1920, p. 197, pl. 5, figs. 23a-c: "Knobstone group; Clark County, Indiana" (New Providence).

***Gaulocrinus robustus*** (Troost),  
n. comb.

*Cyathocrinites robustus* Troost, 1849, p. 419, *nom. nud.*; 1850, p. 61, *nom. nud.*; 1909, p. 98, pl. 7, figs. 12-14: "Keokuk horizon of the Tullahoma formation. Harpeth River and White's Creek Springs, Davidson County, Tennessee" (Wood). "Harpeth Ridge, Davidson County, Tennessee" (Troost's manuscript locality).

*Stemmatocrinus trautscholdi* Wachsmuth and Springer (*pars*), Wood, 1909, p. 98.

*Gaulocrinus trautscholdi* (Wachsmuth and Springer), n. comb.

*Stemmatocrinus trautscholdi* Wachsmuth and Springer, 1885, pl. 9, figs. 7, 8; 1886, p. 256 (180): "Keokuk limestone near Nashville (White's Creek), Tenn."

*Gaulocrinus veryi* (Rowley), n. comb.

*Stemmatocrinus? veryi* Rowley, 1903, p. 133, pl. 38, figs. 7, 8: "... probably Keokuk group, of Cumberland County, Kentucky."

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BOTANY.—*Notes on four eastern species of Gymnosporangium*.<sup>1</sup> W. H. LONG, Albuquerque, N. Mex. (Communicated by JOHN A. STEVENSON.)

This paper reports investigations conducted in 1912 and 1913 in the District of Columbia and vicinity, while the author was in the employ of the U. S. Division of Forest Pathology, on the occurrence of four species of *Gymnosporangium*, *G. clavipes* Cke. & Pk., *G. nidus-avis* Thaxt., *G. effusum* Kern, and *G. juniperi-virginianae* Schw.; on the lesions produced by them on the eastern red cedar (*Juniperus virginiana* L.); and on inoculations made with *G. effusum*.

The purpose of these studies was to determine what species of *Gymnosporangium* occurred in the District of Columbia and adjacent areas, their prevalence and distribution, their action on the host, and to ascertain, if possible, the aecial stage of *G. effusum*.

More than 3,000 red cedars were examined for the presence of *Gymnosporangia*, and a record was made of the distribution on each tree of the species found. Data were taken on the extent and character of the lesions produced. Record for each tree was maintained on an individual card showing size and condition of tree, number of lesions on trunk and branches for each species of

rust, nature and size of each lesion, and any other pertinent data, such as nearness to aecial hosts if any, for each locality studied. Table 1 gives a summation of these data, showing number of trees examined, number infected, and number of trunk and branch lesions found for each of the four species of *Gymnosporangium*.

The investigations were made during the months of April and May, as the lesions are most conspicuous during these months because of the swelling and gelatinization of the telia. April was very rainy in 1912, with intermittent showers and often with mists and fogs making ideal conditions for the maturation and gelatinization of the telia.

Three of these species of *Gymnosporangium* are perennial in the red cedar while the fourth is biennial. The prevalence of each species for any given area can be determined from the telial stage more accurately than from the aecial since the former is not dependent for its appearance on the climatic factors for each season. A dry year would reduce very materially the aecial stage for that year, but would not affect to any great extent the perennial lesions in the telial hosts.

<sup>1</sup> Received March 9, 1945.